





Using of Resource Sources of Interactive Semantic Networks in Offline Translator Training

Rostyslav O. Tarasenko¹ ^a, Svitlana M. Amelina¹ ^b, Serhiy O. Semerikov^{2,3,4} ^c
and Vasyl D. Shynkaruk¹ ^d

¹National University of Life and Environmental Sciences of Ukraine, 15 Heroiv Oborony Str., Kyiv, 03041, Ukraine

²Kryvyi Rih State Pedagogical University, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine

³Kryvyi Rih National University, 11 Vitalii Matusevych Str., Kryvyi Rih, 50027, Ukraine

⁴Institute for Digitalisation of Education of the NAES of Ukraine, 9 M. Berlynskoho Str., Kyiv, 04060, Ukraine

Keywords: Interactive Semantic Network, Terminology Resources, Terminology Databases, Autonomous Learning, Translator.


Abstract: The article focuses on the use of resource sources of interactive semantic networks in translator training, particularly during offline and autonomous learning due to lockdown and martial law situations. The most common external terminology resources associated with interactive semantic networks are identified. The technology of selection and structuring of specialised terminology on the basis of interactive semantic networks for their further use in the study of foreign languages and mastering automated translation systems has been developed and proposed. The criteria for creating and supplementing terminological databases with appropriate structuring of the domain terminology selected on the basis of interactive semantic networks have been defined, namely universality, structurability, convertibility, extensibility. The possibility of further use of terminology bases for foreign language learning using mobile applications, mastering Computer Aided Translation (CAT) systems, mastering Computer Aided Interpretation (CAI) are outlined. Based on the experimental construction of an individual interactive semantic network based on external terminology resources, positive results are stated and directions for further research activities to strengthen the technological training of prospective translators are identified.


1 INTRODUCTION


In a changing world at the beginning of the 21st century, education is also changing rapidly. Learning is now seen as a lifelong process that is essential for adapting to new environments, and therefore for ensuring personal economic and social success. Such learning implies that people have to ‘learn to learn’. Consequently, providing students with the knowledge and skills to enable them to manage their own educational process effectively becomes one of the aims of higher education. During the evolution of the education system, the issue of autonomy has become one of the main themes of language education research, and in the context of recent global developments (the


coronavirus pandemic, COVID-19, restrictive quarantine measures and lockdowns, the transition to distance learning) it has become particularly relevant.

At the same time, the new format of the educational process puts forward new requirements regarding the ways of realising learning objectives, methods of learning communication and teacher-student interaction, means of ensuring the effectiveness of learning subjects and achieving the programme learning outcomes envisaged in the standards and curricula for training specialists, including translators. Both in terms of learning activities and in terms of the future work of translators, technological training is becoming increasingly important. The present is forcing, on the one hand, a strengthening of the technological aspects of university translator training and, on the other hand, a rethinking of the organisational forms of training, the search for appropriate means, the combination of students’ independent mastering of individual study materials with the technologicalization of the

^a  <https://orcid.org/0000-0001-6258-2921>

^b  <https://orcid.org/0000-0002-6008-3122>

^c  <https://orcid.org/0000-0003-0789-0272>

^d  <https://orcid.org/0000-0001-8589-4995>

educational process. Using elements of augmented and virtual reality can meet such complex objective requirements of the current situation.

2 THEORETICAL BACKGROUND

An analysis of the psycho-pedagogical literature has shown that there has recently been increased interest in certain aspects of autonomous learning by both domestic and foreign researchers in different fields of science. Benson (Benson, 2005), noting the recent increased attention to learning autonomy and self-organised learning, including in foreign language learning, emphasised the importance of different levels of student autonomy in distance learning. Cotterall (Cotterall, 2000) identified five principles on which a stand-alone language course should be based and attributed them to learners' goals; language learning process; theory – task, design; learners' strategies; reflection on learning. Hurd et al. (Hurd et al., 2001) emphasise one of the main problems of autonomy in distance learning, which in their view is the difficulty of selecting learning material for students to learn independently. This decision is complicated by two factors. On the one hand, in order to be successful in the programme, students must develop a number of strategies and skills that will allow them to work individually. At the same time, the syllabus of an academic course has a definite structure in which the scope, pace and content of the syllabus are determined by the teacher. Exploring the notion of autonomy in distance language learning, scholars have identified some of the skills that distance learners need to achieve successful outcomes. Similar views are held by Murphy (Murphy, 2006), who emphasizes that the success of autonomy in distance learning depends largely on the teaching materials, and demonstrates the role of the teacher in the process of autonomy in the language distance-learning programme of The Open University in the UK.

While considering the organisation of autonomous language learning, scholars have also explored the possibilities of using information technologies in this process. In highlighting the changes in educational philosophy reflected in the theory of language learning, Pemberton et al. (Pemberton et al., 1996) noted the need to adapt to the rapid changes in the areas of technology, communications, and the labour market and to realise that the ability to learn is now more important than knowledge. In his view, it is advisable to take full advantage of the opportunities for expanding educational services that come with the development of technologies. In

this context, it should be noted that foreign scholars and practitioners are increasingly hoping for the integration of augmented reality elements into the training of university programmes in philology and translation. Indiana University, in particular, has initiated one such project, which involves the multidimensional deployment of elements of AR technology that can meet precisely the specific needs of these programmes in the form of individual modules: “We plan on compiling the following learning modules 1) listening comprehension; 2) pronunciation practice; 3) animated 2D and 3D vocabulary introduction; 4) vocabulary quizzes; 5) roleplay dialogues where students interact with an avatar and 6) videos with cultural content, geography, and history. In contrast to other digital technologies available at IU, such as embedded videos in Canvas, we will be able to bring real objects into language classrooms, such as cultural artifacts, culinary samples, maps and other objects, and connect them virtually to an augmented world” (Scrivner et al., 2016).

According to Reinders (Reinders, 2006), in order to provide students with easy access to learning materials during offline foreign language learning, it is advisable to create an appropriate e-learning environment. The main aim is to support students in their self-directed learning by structuring self-study by providing a recommended sequence of steps, providing students with information on learning strategies and conducting electronic monitoring of student work, with advice if necessary (Reinders, 2006; Scharle and Szabó, 2000).

Researchers whose academic work is related to foreign language teaching point out that special attention should be paid to the development of students' responsibility; otherwise, the learning process will not be successful (Scharle and Szabó, 2000). I. Moore even points out that student autonomy begins with students taking responsibility for both the process and the results of their learning: “In doing this: They can identify their learning goals (what they need to learn), their learning processes (how they will learn it), how they will evaluate and use their learning; they have well-founded conceptions of learning, they have a range of learning approaches and skills, they can organize their learning, they have good information processing skills, they are well motivated to learn” (Moore, 2010).

Little (Little, 2002) considers it likely that in the next few years much of the research on student autonomy will focus on the impact of autonomous learning, particularly when learning a foreign language, on everyone involved – students, teachers and educational systems in general. According to the researcher, the

role of the teacher is to create and support a learning environment in which students can be autonomous. The development of their learning skills cannot be completely separated from the learning content, since learning how to learn a foreign language differs from learning other courses in some important respects.

At the same time, as the above list of issues examined by scholars from various countries shows, autonomous learning, in particular the learning of foreign languages, is associated by many with the using information technologies and the search for new approaches, not the least of which are nowadays augmented, virtual and mixed reality (Liu et al., 2017). Yagcioglu (Yagcioglu, 2015), focusing his research on new approaches to student autonomy in language learning, relies on UNESCO's declared role of information and communication technologies in learning: "Information and communication technology (ICT) can complement, enrich and transform education for the better" (UNESCO, 2022). Some academics, while extremely appreciative of the potential of augmented and virtual reality in learning, have expressed concerns about whether the education system is ready for the fundamental changes in the educational process that arise from these technologies, or even their elements. Ochoa (Ochoa, 2016) sees augmented and virtual reality as a new challenge for education.

The use of terminology resources is an important support both for training (face-to-face, remote, off-line) and for the professional work of translators. It should be noted that, appreciating the importance of correct use and unification of terminology, the European Commission has created a specific database of terminology tools and resources (KCI, 2022). More recently, scholars have noted that the creation of terminological resources should aim at the possibility of using them during both human and machine translation: "In a globalised society, terminological dictionaries – including resources such as knowledge and terminological databases, ontologies, wordnets, "traditional" dictionaries, etc. – should comply with both human and machine needs" (Roche et al., 2019).

Given the importance of the factors for organising offline foreign language learning identified in the reviewed studies (students' motivation, choice and access to learning material, skills and strategies for offline learning, use of information technology, AR technology), we consider it advisable to introduce the use of augmented reality elements in this process, which can provide the above aspects. In previous studies to determine the possibilities of using AR technology in the process of learning a foreign language, a number of advantages of using elements of this technology have been identified: the involve-

ment of different channels of information perception, the integrity of the representation of the studied object, faster and better memorization of new vocabulary, etc. (Tarasenko et al., 2020b). The study of a certain section of a foreign language's vocabulary – domain-specific terminology – is relevant both for specialists studying a foreign language and for translators who plan to translate the field. Therefore, continuing our research, we will focus on autonomous learning activities using AR technology in terminology work, which is the initial phase for several possible directions of further development of the educational process – language learning, scientific and technical translation, mastering automated translation systems (Tarasenko et al., 2020a).

The *purpose* of this paper is to consider the possibility of using interactive semantic networks as elements of augmented reality in the process of autonomous learning to improve the technological training of translators in the aspect of creating domain-specific terminology bases for their further use in foreign language learning and mastering automated translation systems.

3 RESULT AND DISCUSSION

Translation education at the current stage necessarily involves technological training of translators, which aims to develop competencies in the use of modern tools and techniques of translation, based on the use of information technologies. An important part of this training is for translators to acquire skills in working with electronic terminology resources, such as searching, structuring, storing, using terminology in computer-assisted translation (CAT) systems, computer-assisted interpreting (CAI) systems, interactive foreign language learning systems and the like. The search for effective technological training for translators is becoming increasingly urgent, but is complicated by the emergence of new tools and the rapid growth of their number. At the same time, there is a trend towards the increasing use of cloud services and online resources. All this makes it necessary to constantly update the content of the educational programme components. One of the ways of solving this problem could be the implementation of augmented reality elements into the educational process. The application of augmented reality (AR – augmented reality) technology will allow students to find and obtain the necessary information more quickly, which can be presented in symbolic, audio, graphic or animated form (Amelina et al., 2022). The use of such technology will be particularly effective in off-line learn-

ing, as its peculiarity is the absence of constant direct contact with the teacher and, consequently, the possible complications of acquiring certain knowledge. This necessitates a search for augmented reality technologies that were primarily aimed at building professional skills, particularly in the case of autonomous learning for translators in their technological training.

3.1 Technology for Selecting and Structuring Domain-Specific Terminology Based on Interactive Semantic Networks

One of the options for using augmented reality elements in the technological training of translators can be developed by us the technology of selecting and structuring domain-specific terminology based on interactive semantic networks for their further use in the study of foreign languages and mastering automated translation systems. A schema of this technology based on interactive semantic networks is shown in figure 1. This technology is designed to be used in the learning process by undergraduate students who have already acquired the skills of working with CAT and CAI (Tarasenko and Amelina, 2020). In developing it, we used existing interactive semantic networks, which are new online services and have only become available for use in the last few years. In particular, one such service has been developed in the framework of the EU Terminology as a Service (TaaS) project. The goal of the TaaS project was to provide operational access to up-to-date terms based on the exchange of multilingual terminology data and to create effective mechanisms for the reuse of terminology resources.

According to the developed technology (figure 1), the initial step is to use interactive semantic networks for the selection and structuring of domain terminology, which consists in the possibility of defining a semantic field within a certain domain to identify terminological entities for integration in the terminological database of the respective domain. In this case, to initialise the algorithm for the student's construction of his/her individual semantic network, he/she only needs to decide on any source term that relates to the domain with which he/she plans to work on the basis of the created terminological base. This term is entered into the relevant elements of the interface and a hierarchical structure of the semantic field with multi-level relationships between its elements is formed around it by means of the search engine of the interactive semantic network. In this way, the student is at the outset provided with a defined set of direc-

tions, each of which opens up a separate terminology pathway. At the same time, the system provides easy and clear visual identification of the elements in their hierarchical order and the different types of links between them. Figure 2 shows the initial phase of building a personalised interactive semantic network based on the source term "genetics".

Further action should be taken by the student to develop the semantic network in one or more directions that are appropriate for his or her individual task. The types of links between the elements of the network, which indicate the hierarchical relationship between them, can help the student to decide on the appropriate direction. In particular, the system can automatically establish four types of such links: exact, broader, narrower, related. The exact type of link means that it is an exact match or synonymy. In terms of moving along the development of a network with such a link, the system can provide additional opportunities to obtain search results in the form of related terms. Using the network development direction of the broader link, the student will be able to further search for terms at a higher hierarchical level of concepts and move to related domains, which will contribute to his/her understanding of the integrity of a particular domain. A 'narrower' link will allow the student to build a network in the narrower direction of the field and access a list of terms that under other circumstances he/she might have obtained after a lengthy search in the relevant reference books. This is an important aspect of using such online networks, given that the translator is usually not an expert in a particular domain and therefore cannot have a detailed understanding of the terminological vocabulary of that domain.

3.2 Resource Sources for Terminological Support for Interactive Semantic Networks

However, working with an interactive semantic web to find relevant terms can be effective not only in the direction of using the appropriate type of links between the network elements in a visualised mode, but also when using a system of interactive links to relevant terminology resource repositories. This can be used if a student is interested in a specific terminological element in a semantic network schema. When it is highlighted, the system identifies and generates a link to one so-called original site whose information better answers the created query. In most cases, the system identifies three main resources as original sites:

- the Agricultural Information Management Stan-

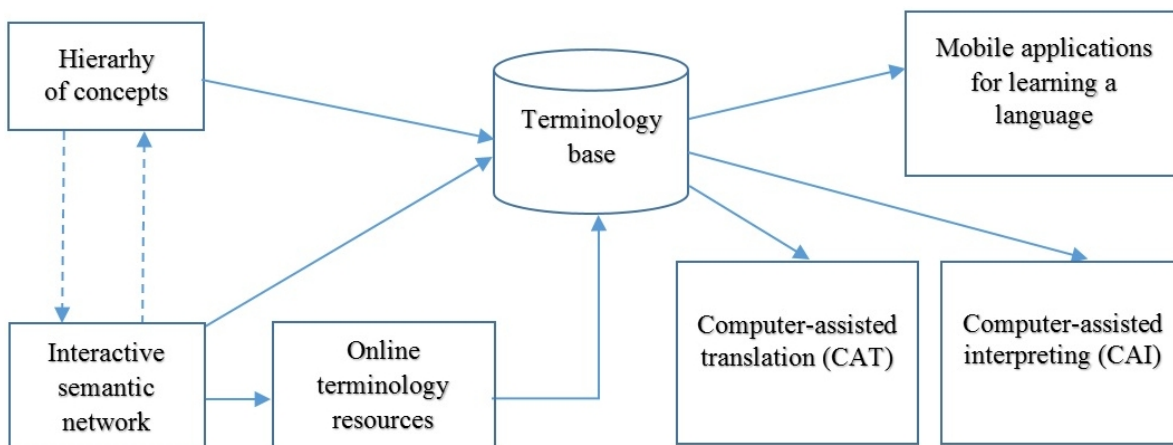


Figure 1: The scheme of technology for selecting and structuring domain-specific terminology based on interactive semantic networks for further use in foreign language learning and mastering computer assisted translation systems.

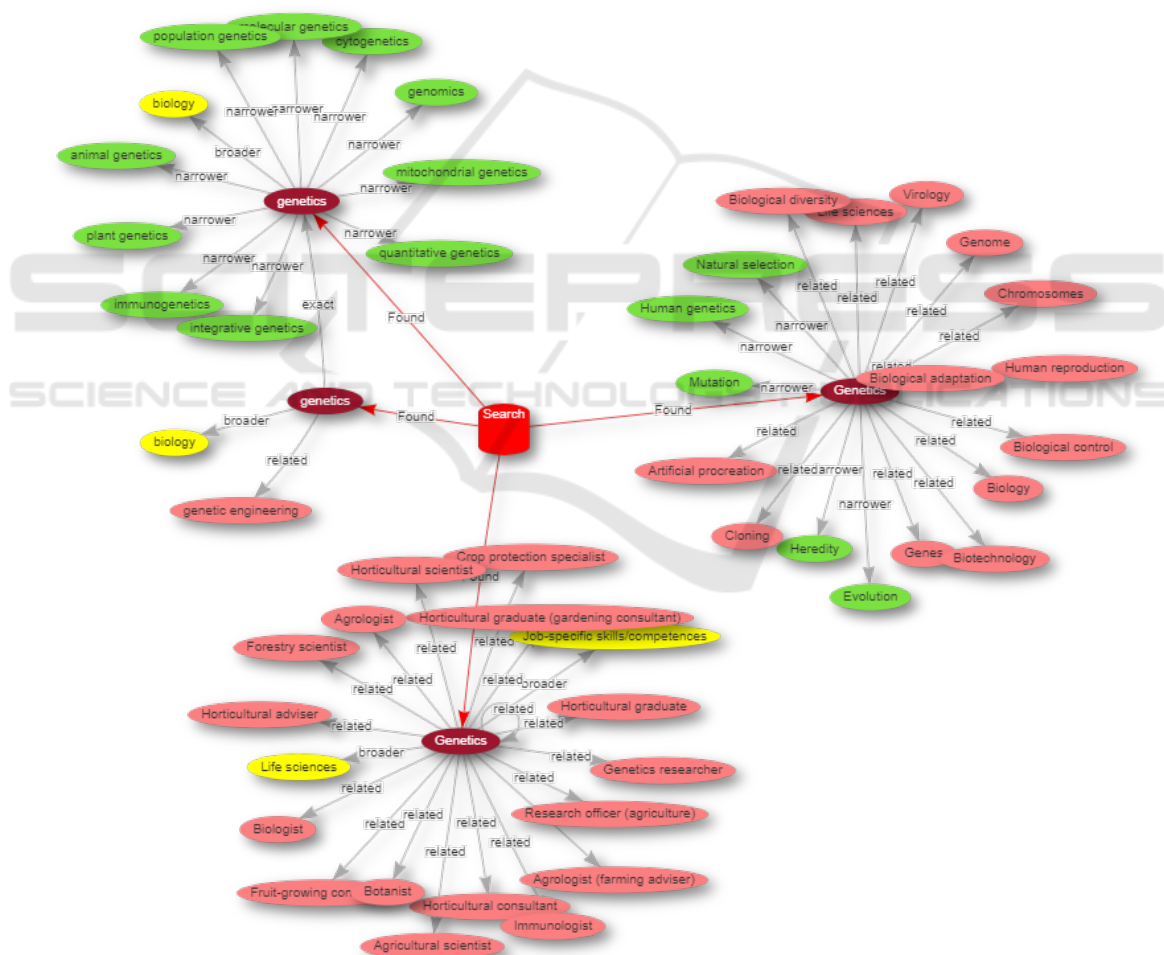


Figure 2: Initial phase of creating a personalised interactive semantic network based on the source term “genetics”.

dards (AIMS) portal of the Food and Agriculture Organization of the United Nations (FAO),

- the UNESCO Thesaurus, which is a structured list of terms used for subject analysis and searching

http://aims.fao.org/aos/agrovoc/c_3222 genetics		pref.label	alt.label	Lang
Property	Value			
rdfs:type	skos:Concept	علم الوراثة		ar
skos:inScheme	http://aims.fao.org/aos/agrovoc	genetika		cs
	http://aims.fao.org/aos/agrovoc/conceptScheme_7a97495f	Genetik		de
skos:broader	http://aims.fao.org/aos/agrovoc/c_925	genetics		en
	http://aims.fao.org/aos/agrovoc/c_34327	Genetica		es
	http://aims.fao.org/aos/agrovoc/c_92382	ژنتیک	علم وراثته	fa
	http://aims.fao.org/aos/agrovoc/c_27577	genétique		fr
	http://aims.fao.org/aos/agrovoc/c_27859	आनुवांशिकी		hi
skos:narrower	http://aims.fao.org/aos/agrovoc/c_2089	genetika		hu
	http://aims.fao.org/aos/agrovoc/c_49985	Genetika		it
	http://aims.fao.org/aos/agrovoc/c_24037	遺伝学		ja
	http://aims.fao.org/aos/agrovoc/c_49986	유전학		ko
	http://aims.fao.org/aos/agrovoc/c_331345	ກຳນົດພັນຊີວະສາດ		lo
	http://aims.fao.org/aos/agrovoc/c_abb380d7	genetik		pl
	http://aims.fao.org/aos/agrovoc/c_34326	Genetica		pt
	http://linkedata.ge.imati.cnr.it:2020/resource/EARTH/73290	генетика		ru
skos:exactMatch	http://eurovoc.europa.eu/5651	Genetika		sk
	http://lod.nal.usda.gov/nalt/9222	genetika		th
	http://lod.gesis.org/thesoz/concept/10042870	พันธุศาสตร์		zh
	http://cat.aii.caas.cn/concept/53497	genetik bilimi	kaitumbilim	tr
	http://www.eionet.europa.eu/gemet/concept/3633	ಜನನಶಾಸ್ತ್ರ		te
	http://d-nb.info/gnd/4071711-2	ജനിതകശാസ്ത്രം		ka
skos:closeMatch	http://dbpedia.org/resource/Genetics	genetika		ro
	http://purl.org/bnct/1540	генетика		uk
skos:broadMatch	http://cat.aii.caas.cn/concept/30871	genetikk		nb
skos:related	http://aims.fao.org/aos/agrovoc/c_34ef5401			
	http://aims.fao.org/aos/agrovoc/c_43edf424			
	http://aims.fao.org/aos/agrovoc/c_78324e1e			

Figure 3: Agricultural Information Management Standards Portal (AIMS) page.

for documents and publications in the fields of education, culture, natural, social and human sciences, communication and information,

- the classification system of international standard nomenclature for the fields of science and technology.

It is important to note that all of these resources support a specific model of knowledge organisation for the World Wide Web, the so-called Simple Knowledge Organisation System (SKOS). This knowledge organisation system greatly facilitates interoperability between different information systems by standardising thesauri, classification systems, taxonomies and subject header systems.

The approaches to the use of these resources differ significantly. In particular, the peculiarity of using the AIMS portal is that in the initial phase of its use, in addition to providing specific information about a particular term, in particular the creation of a list of its entries in different languages, a hierarchical structure of URL links to the sites of a number of libraries, thesauruses, dictionaries, etc. where available terminological resources have a certain relation to the term for which the query is formed (figure 3) is also generated.

An extremely important feature of this portal is the hierarchical structure of the URL links, which allows students to consciously determine the further steps to take in order to find the necessary information about the relevant term. In particular, all links are concentrated into categories: broader, narrower, exactMatch, closeMatch, broadMatch, related. By organising the resource links into these categories, translators can focus their efforts on the resources that are of most interest to them in the context of their particular assignment. The exactMatch category is by far the most

interesting as it groups the resources where you can find the most accurate information on a given term. However, the closeMatch category can also be interesting, as the resources offered there can significantly enhance the understanding of the nature of a term and its application and translation terms. Overall, the AIMS portal offers more than twenty of the world's leading terminology repositories, whose resources are very powerful. A list of the main ones is given in table 1.

An important resource that the Interactive Semantic Web uses as original sites in the initial search for information about a certain term is the UNESCO Thesaurus. It contains a verified and structured list of terms covering a rather broad thematic list in the branches of the different sciences – natural sciences, social sciences and humanities. Terms in the fields of information and communication and education are also presented. Structurally, the thesaurus is divided into seven main thematic areas, which in turn are divided into microthesauri. This clear hierarchical structure allows a quick understanding of the essence of the individual concepts and the connections between them. Each term is accompanied by an explanation of its meaning, which helps to avoid mistakes in its use, and the designation of the number and name of the microthesaurus to which it belongs. When available, synonyms of varying degrees of approximation to the meaning of the term are also indicated. These can be so-called broad, narrow or related concepts. A broad term is represented as a reference to a terminological element that is one level higher in the thesaurus structure. A narrow term, on the other hand, is reflected through a reference to a terminological element one level lower in the thesaurus structure. Related terms are essentially related concepts.

Table 1: Online terminology resources used when working with the Interactive Semantic Web.

The name of the online terminology resource	Support and accompaniment
GEMET (General Multilingual Environmental Thesaurus)	European Topic Centre on Catalogue of Data Sources (ETC/CDS) and the European Environment Agency (EEA)
The National Agricultural Library's Agricultural Thesaurus and glossary	United States government
IATE (Interactive Terminology for Europe)	European Union
TAUS (The language data Network)	
SKOS UNESCO Thesaurus SKOS UNESCO nomenclature for fields of science and technology	The University of Murcia (Spain), UNESCO Chair in Information Management in Organizations
Nuovo soggettario – Thesaurus	The National Central Library of Florence
DBpedia	University of Leipzig and Christian Bizer from FU Berlin (now University of Mannheim)
UNESCO Thesaurus	United Nations Educational, Scientific and Cultural Organization
Standard-Thesaurus Wirtschaft	Leibniz-Informationszentrum Wirtschaft
Katalog Der Deutschen Nationalbibliothek	Deutsche National Bibliothek
Skosmos THESOZ Thesaurus	
AIMS (The Agricultural Information Management Standards Portal)	Food and Agricultural Organization of the United Nations (FAO)
The Library of Congress Linked Data Service	Library of Congress
Bibliothèque Nationale De France	
Chinese Agricultural Thesaurus (CAT)	Agricultural Information Institute of CAAS

The structuring of terms in the UNESCO Thesaurus is shown in figure 4.

A great advantage of using the UNESCO Thesaurus in a translator's work is that this terminology resource is quadrilingual, so the translator can use it both to gain knowledge in order to better understand the industry and therefore the context in which the term is actualised, and directly for translation if the target language is supported by this resource. There are various options to search for a term's description and relationships, which can be done through an alphabetical list or in a hierarchical structure. Hierarchical search options for a term are shown in figure 5.

A valuable terminology resource is of course the IATE (Interactive Terminology for Europe) database (figure 6), created and maintained by the European Union. It contains terminology that is used by EU institutions and agencies, so referring to this terminology database will enable a translator to use harmonised and standardised terminology.

A special feature of the IATE terminology database is that the search results not only match the term in the target language but also the word combinations into which the term is included (figure 7). This makes the translator's job a lot easier, as there can be direct matches for the purpose of his/her terminology search. On the other hand, the terms are

given in their immediate context, which makes it easier for a translator who is not an expert in the relevant field to understand their meaning.

As shown in figure 7, the term crop production can be used in different sectors and domains – environment, agriculture, fish farming, and forestry. Therefore, the results of the search for correspondences to an English term in German are represented by these semantic fields and, as we can see, there are different terms in German as correspondences, depending on the sector.

Before the experimental part of the study, which involved the construction of an individual interactive semantic network by the students on the terminology of their choice, the experimental participants were introduced to the terminology resources described above and presented in table 1. The students could choose any of the suggested terminology resources to realise their goal.



Overview | Browse thesaurus | Alphabetical browsing | Hierarchical browsing | SPARQL Endpoint | Download | Statistics | Credits and legal notice | UNESKOS Vocabulary

Español **English** **Français** **Русский**

RDF/XML | N-Triples | N3/Turtle | JSON | JSON-LD

Soil sciences > Soil conservation

Soil conservation

<http://skos.um.es/unescothes/C03748>

[Search in UNESDOC](#)

Other languages

- **Conservación del suelo (Término español)**
- **Conservation du sol (Terme français)**
- **Сохранение почв (Русский термин)**

Domain → **Microthesaurus**

- **2 Science** → **2.35 Earth sciences**

Broader concepts

- **BT Soil sciences**

Related concepts

- **RT Resources conservation**
- **RT Soil resources**

Figure 4: Structuring of terms in the UNESCO Thesaurus.



SKOS

UNESCO Thesaurus

Overview | Browse thesaurus | Alphabetical browsing | Hierarchical browsing | SPARQL Endpoint | Download | Statistics | Credits and legal notice | UNESKOS Vocabulary

Español **English** **Français** **Русский**

21 concepts with labels containing "soil"

Desert soils (en)

<http://skos.um.es/unescothes/C01013>
Suelo desértico (es), Sol désertique (fr), Пустынные почвы (ru)
2.35 Earth sciences

Saline soils (en)

<http://skos.um.es/unescothes/C03481>
Suelo salino (es), Sol salin (fr), Солончаки (ru)
2.35 Earth sciences

Soil classification (en) → Soils (en)

<http://skos.um.es/unescothes/C03760>
Suelo (es), Sol (fr), Почвы (ru)
2.35 Earth sciences

Soil compaction (en) → Soil mechanics (en)

<http://skos.um.es/unescothes/C03753>
Mecánica de los suelos (es), Mécanique des sols (fr), Почвенная механика (ru)
2.35 Earth sciences

Soil conservation (en)

<http://skos.um.es/unescothes/C03748>
Conservación del suelo (es), Conservation du sol (fr), Сохранение почв (ru)

Figure 5: Results of a search for the term “soil” in the UNESCO Thesaurus.

3.3 Development of a Personalised Interactive Semantic Network with Support for External Terminology Resources

Given the development of the network to cover a wider terminological spectrum, it is advisable to move

along the related type links. The results of the development of the individual interactive semantic network in different directions depending on the type of linkage are shown in figure 8.

At this stage in the implementation of the technology for selecting and structuring sector-specific terminology based on interactive semantic networks, students can already begin to extract selected terms

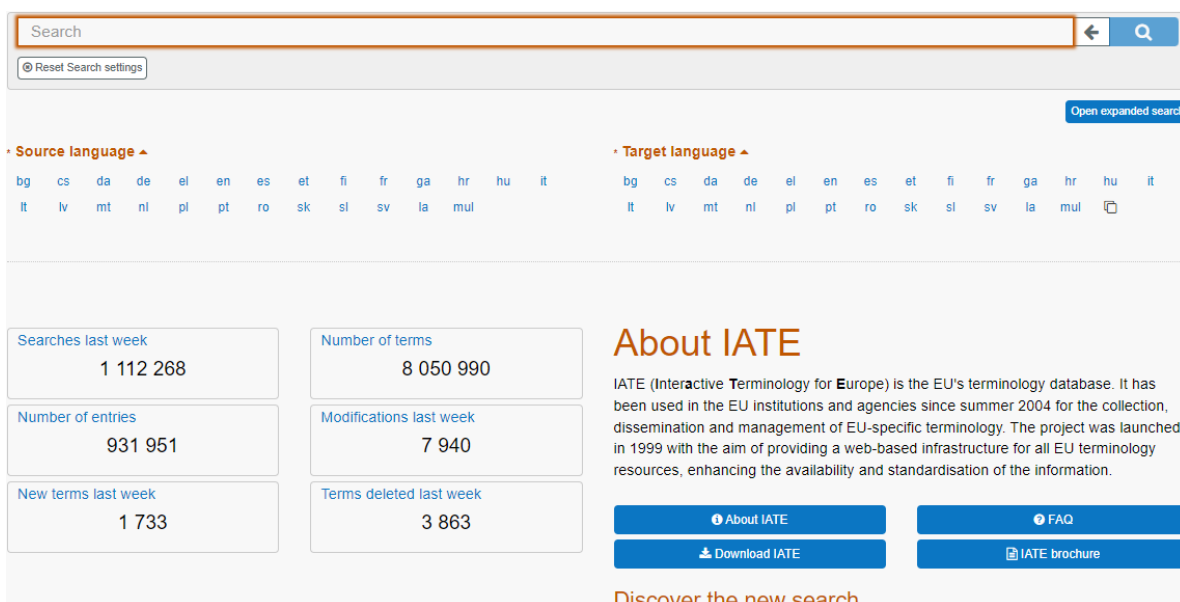


Figure 6: Interactive Terminology for Europe database.

45872		2
ENVIRONMENT		CdT
en	crop production	***
de	Nutzpflanzenproduktion	***
No more exact results found with your settings. Similar results displayed below.		
278463		3
AGRICULTURE, FORESTRY AND FISHERIES		EP
en	crop production group	*
de	Anbaugemeinschaft	*
1351321		4
AGRICULTURE, FORESTRY AND FISHERIES		COM
en	fodder crop production	***
de	Feldfutterbau	***
1177505		5
ENERGY		COM

Figure 7: Search results for the term “crop production” with English as the source language and German as the target language.

from the constructed network and place them into the terminology database. In doing so, the students must be made familiar with the criteria we have defined for creating and completing terminology bases in which it is appropriate to structure domain-specific terminology derived from interactive semantic networks. In defining the criteria, we were guided primarily by the possibility of further use of terminology bases for such purposes as: learning foreign languages using mobile applications, mastering Com-

puter Aided Translation (CAT) systems, mastering Computer Aided Interpretation (CAI) systems, which corresponds to the logic of the developed technology. To such criteria, we have classified:

- universality (ability to meet the need for terminological support for different processes directly or with minimal modification),
- structurability (possibility of placing terms), synonyms, matches and other additional information to the term in compliance with generally accepted

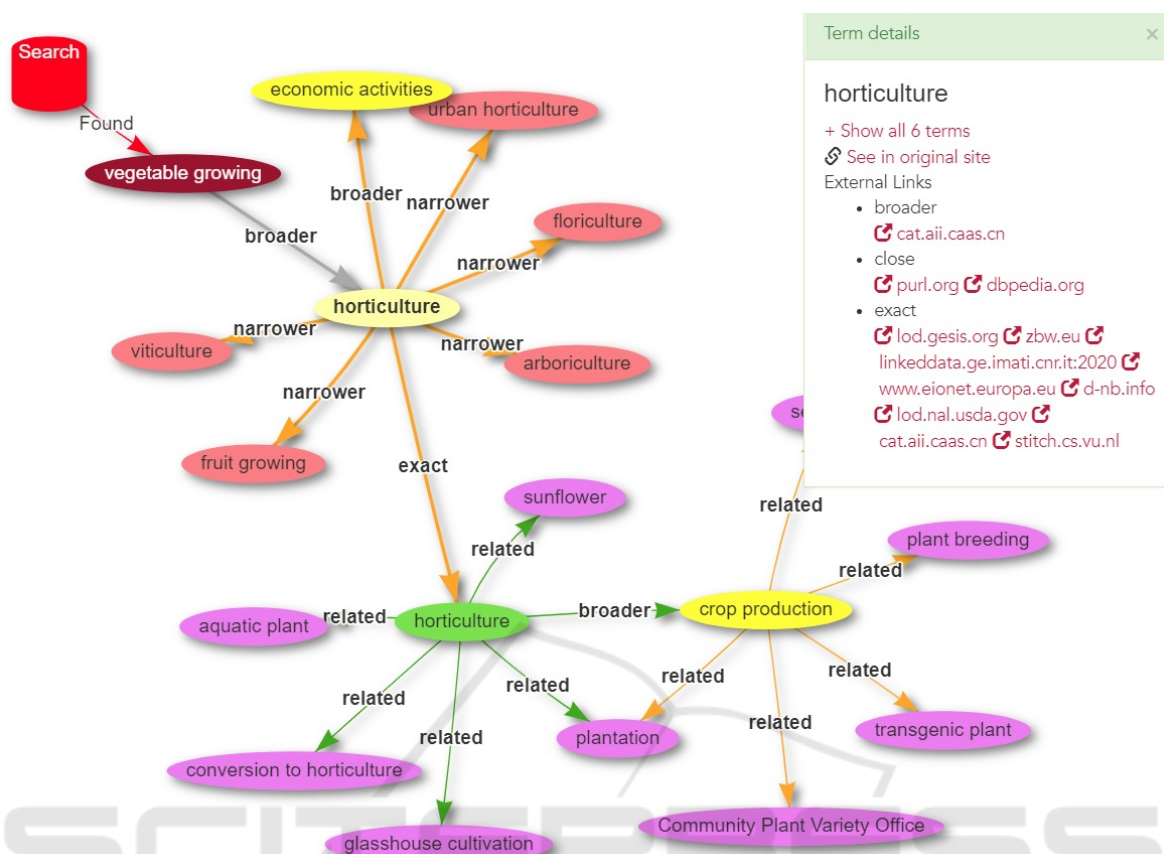


Figure 8: A individual interactive semantic network, developed along different lines depending on the type of relationship.

principles,

- convertibility (the ability to convert to other formats for the needs of other systems without changing the structure and content),
- extensibility (the possibility of changing the structure of the database to accommodate additional information in the entry at any stage of its completion, without loss of data).

After being introduced to these criteria, the students had to decide on their own about the software to create the terminology database, the format of the database and its initial structure. The autonomy given to the students to make such decisions was due to their experience with CAT and CAI and therefore with the terminology bases used in such systems.

However, using the specialised functions of the interactive semantic networks, the students were able to obtain extended information about the terms defined for entry into the terminology base, if necessary. This toolkit is based on the interactive use of online resources that can be accessed via external links and which concentrate a considerable amount of terminology indicating its affiliation to a domain,

its interpretation, definitions of terms, their matching, etc. (figure 3). The online resources used include powerful bases such as: Interactive Terminology for Europe (IATE), General Multilingual Environmental Thesaurus (GEMET), National Agricultural Library's Agricultural Thesaurus and Glossary, LusTRE (multilingual Thesaurus Framework), TAUS (The language data Network) etc.

Using the resources of such databases makes it possible to extend the content of terminology bases beyond the simple structure, containing only terms and their matches, to the use of extended information. In particular, the extension of each terminology entry with additional information such as domain, definition, synonyms, etc. (figure 9) contribute to increasing their informative value. They can be useful when such databases are used with automated translation systems. In this case, the terminology databases should be structured with appropriate fields for structuring such information.

In the list of links to external online resources generated by the interactive semantic network, there can also be resources containing additional information in the form of multimedia documents, electronic

Thesaurus Search

Search term or text to match

Enter the terms you wish to search for.

Language

English

Search method

Terms which contain this character

Number of terms to display

200

Search the Thesaurus

Thesaurus Search Results

horticulture

Subject Category
[F Plant Science and Plant Products](#)

Definition
 Horticulture is defined as that branch of agriculture concerned with growing plants that are used by people for food, for medicinal purposes, and for aesthetic gratification.

Definition Source
 Agricultural Marketing Service, USDA

RDF/XML Format:
<http://lod.nal.usda.gov/nalt/18.rdf>

Persistent URI:
<http://lod.nal.usda.gov/nalt/18>

Broader Term
[Plant Science and Plant Products](#)

Narrower Term
[arboriculture](#)
[bonsai](#)

Change Display

[Show Term Hierarchy](#)

Search for this Term

[Google Scholar](#)
[AGRICOLA Articles](#)
[AGRICOLA Books](#)

Figure 9: Structure of the presenting additional information on the term “horticulture” in the online resource “National Agricultural Library’s Agricultural Thesaurus and Glossary”.

documents, videos, books, images (figure 10). The value of such resources in autonomous learning lies not only in the selection of terminology for terminology bases, but more in the opportunity to understand in detail the nature of the term, the context of its use, and to form an idea of defining the object. With this technology of using semantic networks, students are able to learn more about the objects of a particular domain through a terminological apparatus without being overloaded with redundant information.

It is important to note that a developed interactive semantic network can be automatically converted into another format for displaying its elements, namely by hierarchical structure (figure 11). This format of presenting the network allows students to enhance their ability to explore the constructed network in terms of the interrelationship of its elements, in particular in the aspect of distinguishing more general concepts from highly specialised vocabulary.

According to the scheme of technology for selecting and structuring sector-specific terminology (figure 1), working in the Hierarchy of concepts representation of the interactive semantic network, students can also extract terms from it and add them to the terminology base, but without the possibility of obtaining additional information from the online resources.

3.4 Experimental Testing of the Use of Interactive Semantic Networks with External Terminology Resources in Translator Training

In order to identify the possibilities and ways of using interactive semantic networks with external terminology resources in the process of technological training of translators, we conducted a survey of students who were asked to experience them while they were in distance learning, which created a situation of autonomous learning. Thirty-eight students took part in this type of experiential learning, learning how to create terminology bases with a view to their future use in foreign language learning using mobile applications and mastering the use of computer-assisted translation systems. The questionnaire used for the survey contained 11 questions and provided two alternative answers to each question “Yes” or “No”. The content of the questionnaire, as well as summarised quantitative data on the responses, are shown in table 2.

The responses to the first question show a positive effect on the learning of domain-specific terminology bases precisely in the aspect of term identification and selection technology in the lack of an in-depth understanding of the domain. This was made possible

Horticulture

Topic : Horticulture
 Source file : RAMEAU
 Field : Agriculture, Pêche
 Variant subject headings : Horticulture (France)
 Plantes cultivées – Cultures
 Plantes – Cultures

related to this theme (11 resources in data.bnf.fr)

Broader concept (1)
 Agriculture

Narrower concept (3)

Related Terms (7)

Documents on this topic (256 resources in data.bnf.fr)

Multimedia documents (1)

Videos, films (7)

Electronic documents (7)

Books (217)

Pictures (24)

Figure 10: Structure of presentation of additional information about the term “horticulture” in online resources in the form of multimedia and electronic documents, videos, books, images.

Table 2: Results of a student questionnaire on the using interactive semantic networks.

Question	Response rate, %	
	Yes	No
Did the use of interactive semantic networks help you acquire the skills?	78.9	21.1
Has the use of interactive semantic networks contributed to the identification of related concepts and terms associated with a particular source term?	84.2	15.8
Has the visualised representation of the interactive semantic network contributed to an understanding of the integrity of a particular field in which you are not an expert?	81.6	18.4
Has the use of an interactive semantic network enabled you to understand better the range of components of a particular field in order to detail terminology in the right direction?	73.7	26.3
Does the presence of established relationships between the different hierarchical levels in the interactive semantic network help to outline a terminology dataset for input into the terminology database according to a certain logic?	76.3	23.7
Have you used MS Excel to create and complete your terminology database?	68.4	31.6
Have you used specialised CAT system modules to create and complete your terminology base?	21.1	78.9
Have you used the functionality of computer-assisted interpreting systems to create and complete your terminology base?	10.5	89.5
Did you fill your terminology database with additional information about the terms entered?	34.2	65.8
Have you used the specialised functions of interactive semantic networks to find more information about terms?	39.5	60.5
Have you needed to change the structure of your base in order to expand it?	13.2	86.8

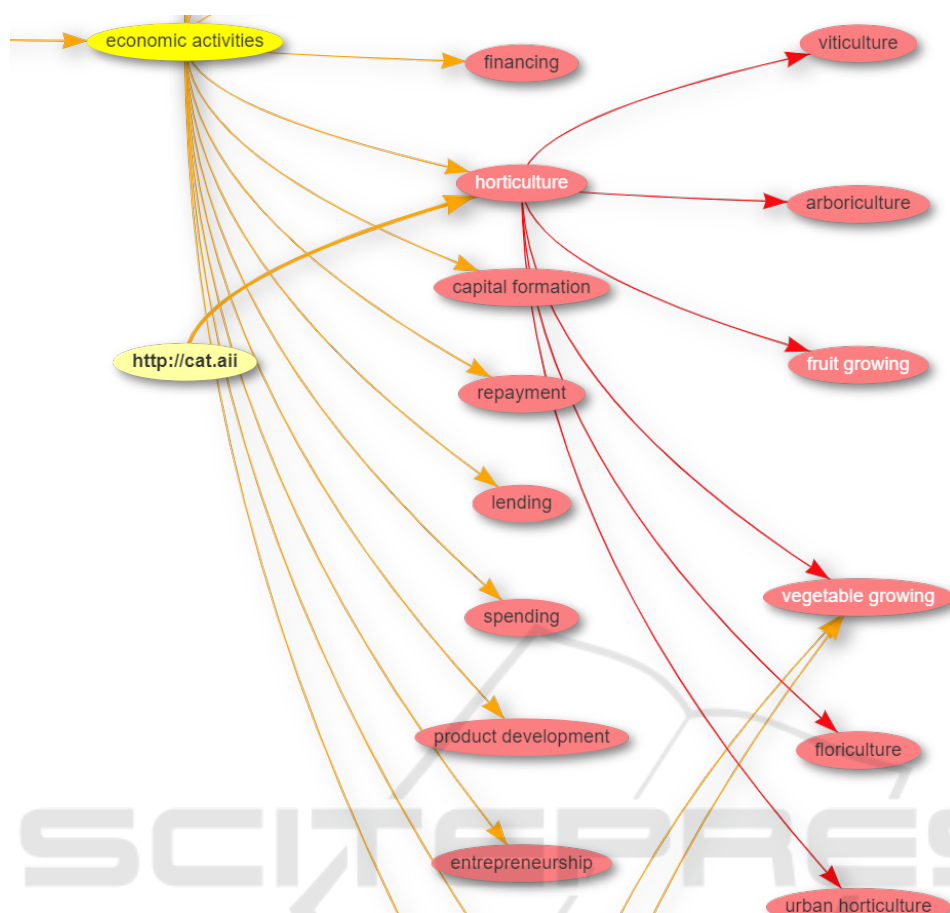


Figure 11: Presentation of the created interactive semantic network with a hierarchical structure.

precisely using interactive semantic networks, as indicated by 78.9% of the students. A convincing proof of the effectiveness of interactive semantic networks was the responses to the second question of the questionnaire, as 84.2% of the students owe it to them to be able to identify related concepts and terms related to a certain source term. In other words, only 15.8% of the students could identify the lexical field of certain terms based on their own prior knowledge in a certain field.

The high number of affirmative responses to the third question (81.6%) is most likely due to the easier perception of information presented in visual form, which is generally an effective support for autonomous learning. In particular, the functionality of the interactive network to visually reproduce the terms of a particular area and the relationships between them contributed to an understanding of its integrity, even at an early stage of familiarity with it.

In addition, the use of an interactive semantic network to highlight terms of a particular domain allowed the students to detail the elements of the terminological system in the right direction quite effectively,

as reported by 73.7%. This kind of activity is directly related to the filling of terminology bases and would have required significantly more time if done by other means.

The availability of an automated function in the interactive semantic network to generate relationships between terms across the four hierarchical levels proved to be an effective tool for 76.3% of the students, who indicated that it allowed them to identify the right set of terminology data to add to the terminology database aimed at solving a specific problem.

The responses to the questions on the software that the students used to create the terminology bases can be explained by the influence of two factors, namely the availability for use of a particular software product and the level of proficiency in it. The fact that 68.4% of students chose MS Excel to create and complete their terminology databases, confirms the fact that the programme is commonly available and the experience of using it is acquired not only in the study of specialised courses, but also in previous phases of mastering information technologies. However, it is important that 21.1% of the students created ter-

minology bases using specialised modules designed to generate such bases when working with CAT systems. This indicates that a fairly large proportion of students have not only mastered these modules to a level which has enabled them to carry out such operations at a higher technological level, but are also aware of possible ways of obtaining and using them. It is important to note that although only 10.5% of students reported using the functionality of CAI systems to create and complete a terminology base, but due to the relatively low prevalence of such systems, this indicates that students valued certain aspects of these systems and gave them preference over others.

Judging by the responses to the question about finding and using additional information about terms, more than a third of the students used the available potential of interactive semantic networks for this purpose. This is an indication that some of the students were not only forming terminological bases, but also trying to understand the essence of the industry in more depth.

Analysing the high number of “No” responses (86.8%) regarding the need to modify the structure of the database in order to expand it, it can be stated that the students had sufficient experience in designing the structure of the terminology bases during the creation phase. This allowed them to predict the necessary fields for concentrating the information available in the semantic network about the term entered in such a way that, in the vast majority of cases, they met the requirements.

Overall, the results of the survey indicate the potential of interactive semantic networks in the process of technological training of translators, in particular for forming terminological bases for their further use in learning foreign languages and mastering automated translation systems.

Given the rather broad list of available external terminology resources related to interactive semantic networks, we also found out which of these resources the participants in the experiment preferred and why. The results of the students’ choices are presented in table 3.

The reasons given by the students for their preference for a particular terminology resource were as follows:

- frequency of hyperlinks to this resource in the interactive semantic web,
- availability of more detailed information about this resource, obtained for familiarisation before the experiment,
- amount of terminology data presented in the database,

Table 3: Results of students’ choice of external terminology resources.

Terminology resource name	Number of cases selected
UNESCO Thesaurus	17
IATE (Interactive Terminology for Europe)	11
The Agricultural Information Management Standards Portal (AIMS)	4
THESOZ Thesaurus	3
The Library of Congress Linked Data Service	3

- specific need for the terminology (e.g. a narrow domain).

In view of these student considerations, it should be noted that the small number of selections of some resources is precisely due to the specific terminological needs of the participants in the experiment and the corresponding orientation of their chosen base. Therefore, this in no way diminishes the value of any terminology resources. At the same time, we have concluded that attention needs to be paid to familiarising students in more detail with the large number of terminology resources available.

Overall, the results of the survey indicate the potential of interactive semantic networks in the process of technological training of translators, in particular for forming terminological bases for their further use in learning foreign languages and mastering automated translation systems. A separate value of this potential is external terminology resources linked to hyperlinks to interactive semantic networks.

4 CONCLUSIONS

In the process of technological training of translators, it has been found that it is advisable to implement elements of augmented reality in order to increase its efficiency. One of these elements can be interactive semantic networks, the technology of using which for the selection and structuring of industry terminology we have developed and tested in the conditions of autonomous learning. This technology allows:

- create a personalised, interactive semantic network to form a domain-specific terminology base,
- to develop a personalised, interactive semantic network along various lines, depending on the need for detailing and structuring domain-specific terminology,

- to select domain-specific terminology on the basis of its detailing, taking into account the types of hierarchical relationships of the interactive semantic network,
- to get more information about terms through the interactive use of external online resources, the links to which are automatically generated by the created semantic networks,
- to investigate the generated semantic networks in the aspect of distinguishing more general concepts from highly specialised vocabulary.

To structure the domain terminology selected on the basis of interactive semantic networks we defined the criteria of creation and filling terminological bases, with possibility of their further use for foreign language learning with mobile applications, mastering computer aided translation (CAT) systems, mastering computer aided interpretation (CAI). These criteria are universality, structurability, convertibility, extensibility.

The experimental use of the developed technology in the process of autonomous training of translators has shown a positive influence on their technological training, in particular in the aspect of the ability to define and select terms when there is no deep understanding of the domain, to detail elements of the terminological system in the right direction, to create terminological bases on the basis of selection and detailing of terms using interactive semantic networks.

In order to informational-terminological support of translators' training and activities and to enhance the use of interactive semantic networks, students were additionally familiarized with external terminological resources hyperlinked to the interactive semantic networks. Because of the experimental use of these resources in the process of building a customised interactive semantic network, it was found that they could meet the specific terminological needs of a translator.

REFERENCES

- Amelina, S. M., Tarasenko, R. O., Semerikov, S. O., and Shen, L. (2022). Using mobile applications with augmented reality elements in the self-study process of prospective translators. *Educational Technology Quarterly*, 2022(4):263–275. <https://doi.org/10.55056/etq.51>.
- Benson, P. (2005). Autonomy and information technology in the educational discourse of the information age. In *Information technology and innovation in language education*, chapter 9, pages 173–193. Hong Kong University Press, Hong Kong.
- Cotterall, S. (2000). Promoting learner autonomy through the curriculum: principles for designing language courses. *ELT Journal*, 54(2):109–117. <https://doi.org/10.1093/elt/54.2.109>.
- Hurd, S., Beaven, T., and Ortega, A. (2001). Developing autonomy in a distance language learning context: issues and dilemmas for course writers. *System*, 29(3):341–355. [https://doi.org/10.1016/S0346-251X\(01\)00024-0](https://doi.org/10.1016/S0346-251X(01)00024-0).
- KCI (2022). Terminology tools and resources. <https://knowledge-centre-interpretation.education.ec.europa.eu/en/content/terminology-tools-and-resources-0>.
- Little, D. (2002). Learner Autonomy and Second/Foreign language Learning. In Bickerton, D., editor, *The Guide to Good Practice for Learning and Teaching in Languages, Linguistics and Area Studies*. LTSN Subject Centre for Languages, Linguistics and Area Studies, Southampton. <https://www.researchgate.net/publication/259874624>.
- Liu, D., Dede, C., Huang, R., and Richards, J., editors (2017). *Virtual, Augmented, and Mixed Realities in Education*. Springer, Singapore. <https://doi.org/10.1007/978-981-10-5490-7>.
- Moore, I. (2010). What Is Learner Autonomy? <http://web.archive.org/web/20100325013329/https://extra.shu.ac.uk/cetl/cpla/whatislearnerautonomy.html>.
- Murphy, L. (2006). Supporting learner autonomy in a distance learning context. In *Gardner (ed.)*, pages 72–92.
- Ochoa, C. (2016). Virtual and augmented reality in education. Are we ready for a disruptive innovation in education? In *ICERI2016 Proceedings*, 9th annual International Conference of Education, Research and Innovation, pages 2013–2022. IATED. <https://doi.org/10.21125/iceri.2016.1454>.
- Pemberton, R., Li, E. S. L., Or, W. W. F., and Pierson, H. D., editors (1996). *Taking Control: Autonomy in Language Learning*. Hong Kong University Press, Hong Kong. <http://www.jstor.org/stable/j.ctt2jc12n>.
- Reinders, H. (2006). Supporting independent learning through an electronic learning environment. In Lamb, T. and Reinders, H., editors, *Supporting Independent Language Learning: Issues and Interventions*, volume 10 of *Bayreuth Contributions to Glottodidactics*, pages 219–238. Peter Lang, Frankfurt. <https://innovationinteaching.org/docs/book-chapter-2006-independent-learning-book.pdf>.
- Roche, C., Alcina, A., and Costa, R. (2019). Terminological resources in the digital age. *Terminology. International Journal of Theoretical and Applied Issues in Specialized Communication*, 25(2):139–145. <https://doi.org/10.1075/term.00033.roc>.
- Scharle, À. and Szabó, A. (2000). *Learner Autonomy: A guide to developing learner responsibility*. Cambridge Handbooks for Language Teachers. Cambridge University Press, Cambridge.
- Scrivner, O., Madewell, J., Buckley, C., and Perez, N. (2016). Augmented reality digital technologies (ARDT) for foreign language teaching and learning. In *2016 Future Technologies Conference (FTC)*,

- pages 395–398. <https://doi.org/10.1109/FTC.2016.7821639>.
- Tarasenko, R. and Amelina, S. (2020). A unification of the study of terminological resource management in the automated translation systems as an innovative element of technological training of translators. In Sokolov, O., Zholtkevych, G., Yakovyna, V., Tarasich, Y., Kharchenko, V., Kobets, V., Burov, O., Semerikov, S., and Kravtsov, H., editors, *Proceedings of the 16th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer. Volume II: Workshops, Kharkiv, Ukraine, October 06-10, 2020*, volume 2732 of *CEUR Workshop Proceedings*, pages 1012–1027. CEUR-WS.org. <https://ceur-ws.org/Vol-2732/20201012.pdf>.
- Tarasenko, R. O., Amelina, S. M., and Azaryan, A. A. (2020a). Improving the content of training future translators in the aspect of studying modern CAT tools. *CTE Workshop Proceedings*, 7:360–375. <https://doi.org/10.55056/cte.365>.
- Tarasenko, R. O., Amelina, S. M., Kazhan, Y. M., and Bondarenko, O. V. (2020b). The use of AR elements in the study of foreign languages at the university. In Burov, O. Y. and Kiv, A. E., editors, *Proceedings of the 3rd International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, May 13, 2020*, volume 2731 of *CEUR Workshop Proceedings*, pages 129–142. CEUR-WS.org. <https://ceur-ws.org/Vol-2731/paper06.pdf>.
- UNESCO (2022). Digital learning and transformation of education: Open digital learning opportunities for all. <https://www.unesco.org/en/education/digital>.
- Yagcioglu, O. (2015). New Approaches on Learner Autonomy in Language Learning. *Procedia - Social and Behavioral Sciences*, 199:428–435. The Proceedings of the 1st GlobELT Conference on Teaching and Learning English as an Additional Language. <https://doi.org/10.1016/j.sbspro.2015.07.529>.